fischer

Installation Manual.

C-Fiber Force Strengthening System:
UV & Moisture Protection FRS-SF
Surface Finish

EN

Safety Instructions
Please read the Safety Data Sheets (SDS) and Technical Data Sheets (TDS) before using the products! When working with chemical products, use suitable protective clothing, protective gloves and safety glasses. IMPORTANT: Please follow the application instructions, which are included in every package.

 These application instructions were created with care. However, fischerwerke GmbH & Co.KG does not take over any liability for any errors in these application instructions and their consequences. There is also no liability for direct or consequential damage taken from incorrect use of the products.

Performance of construction materials (Epoxy resins) vary with external conditions (e.g. project site conditions such as temperature or humidity).

The suitability of the strengthening kit must be checked and confirmed by the responsible planer. All product names and brand names used belong to the owner, even if not explicitly marked as such. The content is subject to changes.

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Content

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1 Introduction

This installation manual describes the installation of the FRS-SF UV-Protection Coating to prevent UV-induced or moisture induced aging of fischer FRS-L-S, FRS-L-H, FRS-L-S NSM, FRS-W U300 and FRS-W U600. The epoxy materials might be sensitive to UV rediation. The FRS-SF has been tested together with our strengthening producs and is furthermore certified according to EN 1504-2. This document must be used or referred to in conjunction with all relevant Technical Data Sheets (TDS), Safety Data Sheets (SDS), Technical Assessments and project specifications. Structural strengthening works shall only be carried out by experienced and trained specialists. For professional product trainings and in case of any questions about our design software REINFORCE-FIX©, please consult the technical team of the national fischer subsidiaries. Note that the inadequate choice on the strengthening or retrofitting method, incorrect structural design, inadequate installation might cause significant risks.

2 System description

2.1 Intended use

In case of exposure other than classes X0, XC1 and XC3 according to DIN EN 1992-1-1 of CFRP Laminates and CF Fabrics, a protective coating (FRS-SF) is required to prevent aging due to UV-radiation and / or permanent moisture. The FRS-SF Surface Finish Coating is tested according to EN 1504-2 and provides a long lasting protection for the CFRP strips and CF Fabric from radiation or spray water and moisture.

2.2 References

This installation manual was written in accordance with the recommendations in ACI 440.2R (2017) and the DAfStb Guideline (Strengthening of concrete members with adhesively bonded reinforcement, Part 3: Execution, 2012).

2.3 Restrictions

This product shall only be used for its intended purpose. Further design details or design information are to be found in the structural design, technical drawings, specifications and risk assessments of the corresponding design engineer or specialist contractor.

3 fischer C-Fiber Force Strengthening System

The primary intended application scope of the fischer C-Fiber Force Strengthening System is to strengthen reinforced or prestressed concrete members. The UV-Protection Coating FRS-SF is a component of the fischer C-Fiber Force Strengthening System.

Table 1: Constituents of the fischer C-Fiber Force Strengthening System with corresponding short product descriptions

Product name	Description
FRS-L-S & FRS-L-H FRS-L-S NSM	Pultruded, precured carbon fiber reinforced polymer (CFRP) Laminates for the structural strengthening
FRS-CS	Thixotropic, 2-component epoxy mortar for the installation of CFRP Laminates and steel plates
FRS-W U300 FRS-W U600	Unidirectional Carbon Fiber Fabrics with 300 g/m² or 600 g/m² area density
FRS-FC	Unidirectional open-end high-strength carbon fiber anchor for optimal end-anchorage of Carbon-Fiber Fabrics
FRS-CF	Thixotropic, 2-component epoxy-based saturating resin for the application of FRS-W and FRS-FC
FRS-PC 11	Thixotropic, high-viscosity, low-shrinkage, 3-component epoxy-based concrete repair mortar for reprofiling, surface levelling and for increasing or restoring concrete cover
FRS-BA	2-component, epoxy-based, solvent-free high performance bonding agent for optimal adhesion between different concrete repair mortars and existing concrete as well as corrosion protection for embedded steel reinforcing bars
FRS-CP red FRS-CP grey	Low viscosity, 2-component, epoxy-based corrosion protection primer for exposed steel surfaces as well as embedded steel rebars in two colour versions, red and grey
FRS-SF	Highly UV resistant and water repellant, waterborne protective coating with high durability against environmental exposure for CFRP reinforcement in outdoor applications
FRS-FP	Waterborne, intumescent coating for CFRP strengthening systems against fire and smoke development
FRS-CA	Universal cleaning agent for the FRS-L-S and FRS-L-H CFRP Laminate and tools

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4 Certification and technical approval

The intended use of the fischer C-Fiber Force Strengthening System using externally bonded CFRP Laminates and CF Fabrics is regulated by:

- ICC-ES Evaluation Report (ESR-4774) “Concrete Strengthening using the C-Fiber Force Strengthening System”.
- European Technical Assessment (ETA-24/0281) according to the European Assessment Document EAD 160086-01-0301 (Kits for the strengthening of concrete elements by externally bonded CFRP strips and near surface mounted CFRP strips).

Note: Although the UV-Protection Coaing FRS-SF is not explicitely regulated and listed in the abovementioned assessment documents, the FRS-SF was excessively tested together with our strengthening products. The FRS-SF complies with EN 1504-2.

5 Storage conditions

The materials shall be stored in closed and undamaged original packaging in a dry environment at ambient temperature. Please note the minimum and maximum storage temperature and the shelf life in the corresponding product data sheets and product labels.

The FRS-SF UV Protection Coating should only be stored and transported in the original packaging.

6 Recommended equipment

6.1 Equipment, devices, tools and accessories

For the adequate coating of FRS-L-S, FRS-L-H, FRS-L-S NSM, FRS-W U300 and FRS-W U600 with FRS-SF UV-Protection Coating, it is recommended to have the following equipment on site:

- Airless spray with a 0.019–0.021 inch nozzle (150-190 bar)
- Brush
- Roller

6.2 Cleaning of tools and accessories

All tools and processing accessories must be cleaned immediately after use with fresh water or another suitable solvent. Dried materials can be removed using the FRS-CA Cleaning Agent.

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7 Health and safety

7.1 Risk assessment

All health and safety risks must be assessed and adequate countermeasures shall be defined. This includes the very condition of the structure and the resulting risks thereof, the processing of all materials used on site as well as working methods.

All work and working procedures must be carried out in full compliance with the relevant local safety and environmental regulations in force on site.

7.2 Personal safety

During the installation, safety shoes, safety gloves and other suitable skin protection must be always worn. It is strongly recommended to use adequate disposable safety equipment during the processing and application of the materials. Since epoxy adhesives or impregnating mortars can cause skin irritation, always wear protective gloves e.g. nitrile-based hand gloves when working with them. Unprotected skin must always be covered with protective cream before starting work.

Always wear suitable eye protection during processing, mixing and installation of the products. It is recommended to carry an eye wash at all times. Always wash hands with suitable soap and clean water after processing the materials.

The work area must be well ventilated, and workers should take regular breaks in the fresh air, to avoid health problems. **P2 respiratory protection mask must be worn during spray application.**

7.3 First aid

If the waterborne coating material comes into contact with the eyes or mucous membranes, contact lenses must be removed and the eyes must be rinsed immediately with clean, warm water for 10–15 min and a medical doctor should be consulted.

If chemicals come into contact with the skin, it must be cleaned immediately and carefully rinsed with clean warm water.

In case an accident happens, despite all of the preventive measures, the corresponding SDS must be immediately handed over to the emergency services. This helps the emergency services to select the appropriate medical treatment(s). For detailed health and safety information, refer to the relevant Safety Data Sheet (SDS) of the individual products.

7.4 Waste disposal

Excess materials must not be poured down in drains or into water supplies. Waste and packaging must be disposed by specialized waste management companies or partners in accordance with local legislation and official requirements. Furthermore, chemical materials should not enter the soil, watercourses, drains or sewers. Chemical waste in undried form must be disposed as hazardous waste.

Waste in the form of dried coatings can be safely disposed of as normal construction waste in accordance with local legislation. For detailed environmental and safety information, refer to the relevant Safety Data Sheet (SDS).

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8 Installation steps

During the installation process the wear of adequate safety equipment (safety gloves, safety glasses, safety mask) is recommended. Technical and safety datasheets should be available on site and consulted prior to installation.

Preparation

Environmental conditions

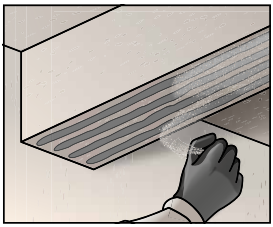
- Surface temperature and environmental temperature should be higher than +5 °C and at least 3 K above dew point during and after application for the drying time. The temperature should not exceed 25 °C.
- The temperature should be between 5 °C and 30 °C and the relative humidity should be below 85 % and the temperature of the substrate at least 3 K above dew point.

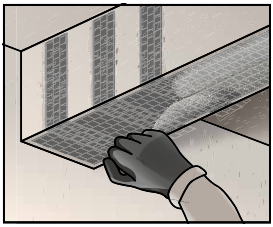
Concrete substrate conditions

- The concrete surface and externally bonded reinforcements need to be dry.
- In case FRS-W CF Fabrics or FRS-L-S NSM near-surface-mounted CFRP Laminates are to be coated, an additional sprinkling with sand prior to the application of FRS-SF is recommended to promote better adhesion.
- The concrete surface, CF Fabrics and CFRP Laminate needs to be dry, oil, dust-free and free of any chemically separating substances.

Surface preparation

In this Installation Manual, the installation procedure of the FRS-L-S and FRS-L-H, FRS-L-S NSM CFRP Laminates, FRS-W carbon fiber fabric is not discussed in detail. For the detailed installation steps of the abovementioned prodcuts please refer to the corresponding datasheets and installation manuals.

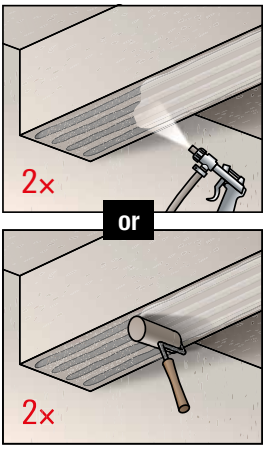




In case carbon fiber fabric (FRS-W U300, FRS-W U600) or near surface mounted CFRP Laminate (FRS-L-S NSM) are to be coated with FRS-SF, it is recommended to sprinkle sand into the uncured FRS-CF or FRS-CS prior to the application of FRS-SF. The sand-sparkling promotes a better adhesion between the underground and the subsequent FRS-SF protection coating. It is recommended to apply sand sparkling within the pot life of FRS-CS or FRS-CF after the installation of CFRP Laminate or Carbon Fiber Fabrics (FRS-CS: within 45 minutes at 20°C, FRS-CF: within 60 minutes at 20°C).

In case of externally bonded CFRP Laminates (FRS-L-S, FRS-L-H), the UV Protection Coating FRS-SF can directly be applied onto the CFRP laminate surface.

Installation of the UV Protection Coating FRS-SF on near surface mounted CFRP Laminate



The application of the FRS-SF is carried out on the surface, onto which sand was previously hand-sprinkled.

Stir up the material FRS-SF properly to homogenize the coating material before application.

The FRS-SF can be applied via airless spray using a 0.019–0.021 inch nozzle at 20°–40° spray angle and 150 bar – 190 bar pressure. A tubing with a diameter of at least 10 mm and a maximum length of 60 m should be used. Alternatively FRS-SF may be applied manually with a brush or roller. Make sure that the ventilation during processing is sufficient.

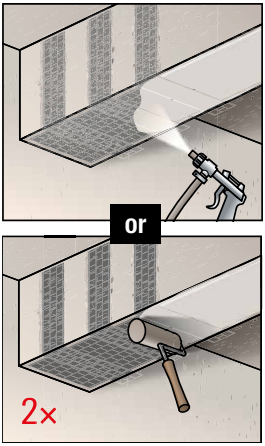
FRS-SF should be applied in at least two layers of a wet film thickness of 0.20 mm. Higher film thicknesses can be applied but will result in long drying times. It's important to cover the edges adequately, corners, and adhesive joints of CFRP Laminates. Additionally, it's significant to cover the concrete surface next to the applicated CFRP materials to get an complete covered area. The approximate consumption is around 0.3 kg/m2 for a film thickness of 0.20 mm depending on the surface roughness of the concrete substrate.

The drying time of a 0.20 mm layer at 20 °C is approximately 8 h until the layer can be overcoated.

Application equipment can be cleaned with water directly after application. Dried remains can be removed using FRS-CA.

Coated surfaces need to be protected from rain and dew water until drying is complete.

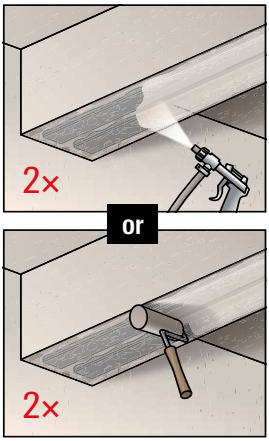
Installation of the UV Protection Coating FRS-SF on CF Fabric



The application of the FRS-SF is carried out on the surface, onto which sand was previously hand-sprinkled.

The installation steps are the same as for the "Installation of UV Protection Coating FRS-SF on near surface mounted CFRP Laminates" (see above).

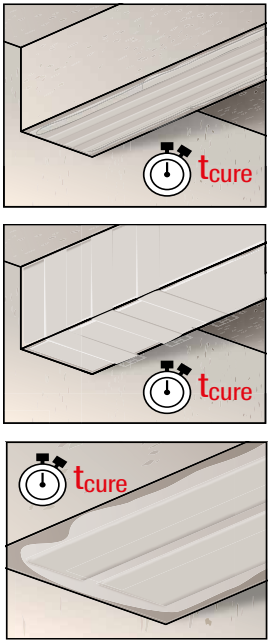
Installation of the UV-Protection FRS-SF on Externally Bonded CFRP Laminates



The UV Protection Coating FRS-SF can directly be applied on the surface of the externally bonded FRS-L-S and FRS-L-H CFRP Laminates (without prior sand sprinkling).

The installation steps are the same as for the “Installation of the UV Protection coating FRS-SF on near surface mounted CFRP Laminates” (see before).

Curing of the UV Protection Coating FRS-SF



Drying times at a film thickness of 0.20 mm are given below:

10 °C: 8.0 h 20 °C: 5.5 h 30 °C: 3.0 h

Inspection and quality control after the installation

The quality of the coating on the CFRP Laminates can be checked via cross cut tests according to DIN EN ISO 2409 (GT < 2 for the FRS-SF top coat on the CFRP Laminates).

All optical and mechanical inspections of the installation of the strengthening system need to be performed before coating the strengthening system with FRS-SF.

The concept of the quality inspection plan of the strengthened structure or structural member is the duty of the responsible structural engineer, following the national and international regulations.

9 Legal notes

The above information, in particular the suggestions for processing and use of our products, are based on our knowledge and experience under normal conditions, provided the products have been stored and used properly. Due to the different materials, substrates and deviating working conditions, a guarantee of a work result or liability, from whatever legal relationship, can neither be justified from these instructions nor from verbal advice, unless we are charged with intent or gross negligence in this respect. In this context, the user must prove that he has in writing all knowledge required for a proper and reasonable assessment by fischer, has been communicated to fischer thoroughly and on time. The user must test the products regarding their suitability for the intended use.

The product specifications are subject to change without notice. Third party property rights must be observed. In all other respects, our respective terms and conditions of sale and delivery apply. Always the latest product data sheet (TDS) applies, which should be requested from us.

10 References

[1] ACI 440.2R-17 “Guide for the Design and Construction of Externally Bonded FRP Systems for Strengthening Concrete Structures”, ACI Committee 440, American Concrete Institute, Farmington Hills, United States of America, 2017.

[2] DAfStb-Guideline “Strengthening of concrete members with adhesively bonded reinforcement”, W. Finckh, A. Ignatiadis, R. Niedermeier, U. Wiens, K. Zilch, Deutscher Ausschuss für Stahlbeton e. V. – DAfStb, Berlin, Germany, 2012.

[3] ESR report 4774 according to AC125 Acceptance Criteria for Concrete and Reinforced and Unreinforced Masonry Strengthening using Externally Bonded Fiber-Reinforced Polymer (FRP) Composite Systems, ICC Evaluation Service, Brea, United States of America, 2024.

[4] ACI PRC-546-14 “Guide to Concrete Repair”, ACI Committee 546, American Concrete Institute, Farmington Hills, United States of America, 2014.

[5] ICRI 310.2R-2013 “Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair”, International Concrete Repair Institute, Inc., Minnesota, United States of America, 2013.

[6] ACI 224.1R-07 “Causes, Evaluation, and Repair of Cracks in Concrete Structures”, ACI Committee 224, American Concrete Institute, Farmington Hills, United States of America, 2007.

[7] EN 1504-9:2008 “Products and systems for the protection and repair of concrete structures – Definitions, requirements, quality control and evaluation of conformity – Part 9: General principles for the use of products and systems”, European Committee for Standardization, Brussels, Belgium, 2008.

fischer stands for

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